Renewable Energy and Stable Development Project № 2 for International Cooperation in 2017

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Research area: **Environmentally friendly alternative power systems using renewable (solar) energy. Autonomous systems of fresh water production and supply.**

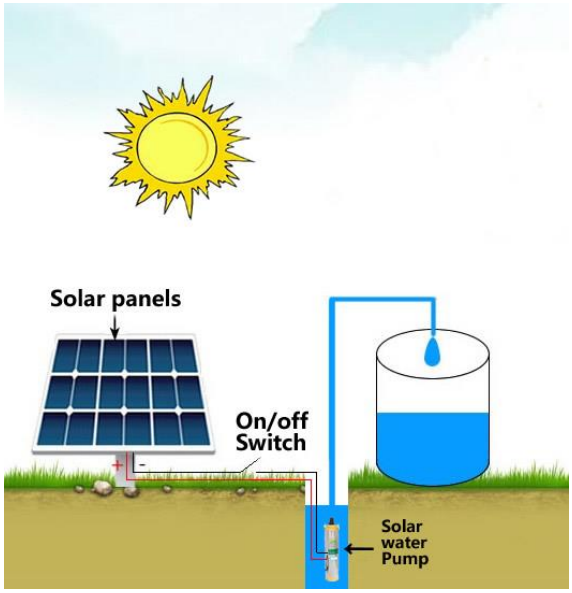
Title of project: **Development of autonomous water supply systems by using solar photovoltaic systems.**

Abstract

It is well known, that humanity is faced with a significant deficit of fresh drinking water, especially in the African-Asian region. One of the problems is the lack of centralized electrical supply for the operation of artesian wells, pumping water and cleaning systems in remote areas, hospitals, research stations, etc. In arid regions of the planet this problem becomes critical for the survival of the population.

At the same time the regions that lack of drinking and fresh water are typically located in hot climates in the conditions of high solar radiation. Therefore, using of autonomous photovoltaic systems can be one of the most effective solutions to this problem on the basis of renewable energy sources. In addition, the deepening of the global energy crisis, lack of basic hydrocarbon fuels including the European countries, makes the autonomous water supply systems based on solar electricity an essential factor for sustainable development.

At present in the world the small cottage (dacha) settlements and other compact living places outside the cities become large enough popular, where there is no centralized water supply systems. In addition, accounting the low quality of drinking water from existing and often badly worn water systems, it is highly relevant the establishment there autonomous water supply systems with its own water tower, pumping station and electrical supply system.



One of the most promising "green" technologies for autonomous power supply is to convert sunlight into electrical energy by using photovoltaic (PV) systems. As is known, the efficiency of modern widely produced silicon monocrystalline photovoltaic modules is about 14-16% and the specific power of electricity generated is about 150 W/ m^2. The specific power consumption of well pumps is approx. on the level of 15-20 watts per meter of water rise. With the current cost of PV modules of about $1.5 per 1 watt of power, the autonomous solar power supply (not including mounting structures) for the water rise by one meter will cost about $25-30.

For example, the water supply from the depth (or to the height) of 30-40 meters needs solar battery power of about 600 watts with a total area of 4 m^2 and cost $900. Accounting that the cost of solar panels installation is one-time and the lifetime of today's PV modules according to the manufacturers declaration is up to 25 years, the invested funds will be repaid in a relatively short time. The area occupied by the solar panels is quite compact and the continuous operation of the pump in a day of sunlight can provide the local area with the drinking water, accounting the night intakes by using a storage tank for drinking water (water tower).

An additional advantage of such systems is a significant reduction in cost due to the absence of chemical batteries, charge controllers and inverters, that increases the overall efficiency of solar energy conversion as well.

As an option, the proposed water supply system on the basis of autonomous solar electricity can be used for fountains operation in parks, squares and city centers.

The objectives of this project are to develop and investigate the working model of effective system of autonomous water supply on the basis of solar photovoltaic modules. In the course of the project the most optimal design of the proposed installation will be determined, the experimental test bench with automatic control system will be assembled and the main operational, power and cost parameters will be investigated. It is planned as performing mathematical modeling of the diurnal cycle of system's operation and experimental study of the working model on the basis of the computer data acquisition system. As a result of the project the analysis of the main technical and economic indicators and evaluation of competitiveness of this technology at the market will be performed. Practical results of the proposed autonomous water supply systems investigation can be used to solve the problems with drinking water production in many countries around the world, including Ukraine, by scaling the installation to a given power.